SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN THAT WE, Kimikazu Furukawa, a citizen of Japan residing at Kawasaki-shi, Kanagawa, Japan, Tomoyoshi Takebayashi, a citizen of Japan residing at Kawasaki-shi, Kanagawa, Japan, Toshihiro Azami, a citizen of Japan residing at Kawasaki-shi, Kanagawa, Japan, Katsutoshi Yano, a citizen of Japan residing at Kawasaki-shi, Kanagawa, Japan, Jun Kakuta, a citizen of Japan residing at Kawasaki-shi, Kanagawa, Japan and Yasuo Sato, a citizen of Japan residing at Kawasaki-shi, Kanagawa, Japan have invented certain new and useful improvements in

COMMUNICATION SUPPORT SYSTEM FOR PROVIDING SECURITY OF
TELEPHONE SERVICES OF A DATA PROCESSING DEVICE FOR A
TELEPHONE USER

of which the following is a specification : -

1   TITLE OF THE INVENTION

COMMUNICATION SUPPORT SYSTEM FOR
PROVIDING SECURITY OF TELEPHONE SERVICES
OF A DATA PROCESSING DEVICE FOR A TELEPHONE USER

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BACKGROUND OF THE INVENTION

(1) Field of the Invention

The present invention relates to a
communication support system which is adapted to
10   connect a telephone unit through a communication
control device to a data processing device and adapted
to connect a telephone network to the communication
control device, when the user transmits a command
signal from the telephone unit to the data processing
15   device to obtain a computer-assisted telephone service
from the data processing device. Further, the present
invention relates to a computer readable medium which
stores program code instructions for causing a
processor to execute a telephone service processing in
20   response to a command signal sent by the telephone
unit.

Personal computers for home use are
becoming widespread. Modems have now been shrunk to a
chip size, enhancing the popularity in personal
25   computers. The increasing prevalence of the personal
computers having a built-in modem makes it easier to
access the Internet or other communication networks
through telephone lines. In recent years, the
telephone lines have been shared by the computers and
30   the telephones.

In recent developments, there is a
demand for a useful, advanced communication support
system which enables a telephone user to use a
telephone unit to remotely control a personal computer
35   (or a data processing device) in order to obtain
computer-assisted telephone services. Currently, the
computer-assisted telephone services are provided only

1   by locally operating the data processing device, and
    the telephones and the computers are separately used.
    Further, it is desired to provide a communication
    support system which allows the telephone user to
5   easily transmit data to or receive data from other
    communication media.
              (2) Description of the Related Art
              A conventional communication support
    system which provides existing telephone services by
10 executing an application program installed in the
    system is known. The conventional communication
    support system provides the telephone services only
    when the user locally operates an input device (such
    as a keyboard or a mouse) of a personal computer.
15 That is, when one of the telephone services is
    obtained from the conventional communication support
    system, the user must be located in front of the
    personal computer and locally operate the input device
    of the personal computer.
20   FIG. 20 shows such a conventional
    communication support system.
              As shown in FIG. 20, in the
    conventional communication support system, an existing
    telephone unit 301, a data processing device 304, and
25 a line unit 303 are provided. The telephone unit 301
    is connected through the line unit 303 to the data
    processing device 304, and the telephone unit 301 is
    connected through the line unit 303 to a telephone
    network 302. The data processing device 304 is, for
30 example, a personal computer. The telephone network
    302 is, for example, a public switched telephone
    network.
              In the above-described conventional
    system, a voice input/output unit 305, a dialing unit
35 306 and a signal detection unit 307 are connected to
    the line unit 303. Further, a personal-computer (PC)
    interface unit 308 is provided between the data

processing device 304 and the units 305, 306 and 307.

The voice input/output unit 305 supplies a voice signal sent from one of the telephone unit 301 and the telephone network 302, to the data processing device 304 via the PC interface unit 308, and supplies a voice signal derived from digital data stored in the data processing device 304, to one of the telephone unit 301 and the telephone network 302. The dialing unit 306 provides an existing dialing function to transmit a call to a destination terminal over the telephone network 302 according to a telephone number input by an input device (such as a keyboard or a mouse) of the data processing device 304. The signal detection unit 307 detects various signals sent from a telephone line, such as a busy tone signal, a ring tone signal, a ring back tone signal, an on-hook signal, and an off-hook signal.

In the above-described conventional system, telephone services are provided by an existing telephone service application program executed by the data processing device (or the personal computer). Such telephone services include, for example, voice recording and playback, file transmission, and telephone number entry.

In the above-described conventional system, when a user of the data processing device 304 sends a call to a destination terminal in the telephone network 302, the application program installed in the data processing device 304 is executed. The user inputs the telephone number of the destination terminal and presses a dialing button on a monitor of the data processing device 304 by manipulating the keyboard or the mouse of the data processing device 304. In this case, the user goes to the location of the telephone unit 301 apart from the data processing device 304, and lifts a handset of the telephone unit 301. Then the off-hook signal from the

telephone unit 301 is detected by the signal detection
unit 307. The telephone unit 301 is connected to the
telephone network 302 (or the destination terminal) by
the line unit 303, and this enables the user of the
telephone unit 1 to communicate with a person of the
destination terminal over the telephone network 302 by
voice.

However, in the above-described
conventional system, it is impossible for the
telephone user to transmit a call to the destination
terminal in the telephone network 302 by using only
the telephone unit 301 to remotely control the
application program in the data processing device 304.

In the above-described conventional
system, when a voice recording function, as one of the
telephone services, is obtained by executing the
application program in the data processing device 304,
the user of the data processing device 304 presses a
recording start button on the monitor by operating the
input device of the data processing device 304. In
this case, the data processing device 304 acquires
voice data from the telephone unit 301 or the
telephone network 302 through the voice input/output
unit 305. The application program in the data
processing device 304 converts the voice data into
digital data in a computer-readable format and stores
the digital data in a memory of the data processing
device 304. The application program continues to
provide the voice recording until a recording end
button on the monitor is pressed by the user.

However, in the above-described
conventional system, it is impossible for the
telephone user to start the voice recording processing
by using the telephone unit 301 to remotely control
the application program in the data processing device
304.

In the above-described conventional

1   system, when a playback function, as one of the
telephone services, is obtained by executing the
application program in the data processing device 304,
the user of the data processing device 304 presses a
5   playback start button on the monitor by operating the
input device. In this case, the application program
in the data processing device 304 converts the digital
data stored in the memory of the device 304 into voice
data, and supplies the voice data to the voice
10   input/output unit 305. A voice signal is derived from
the voice data by the voice input/output unit 305, and
the voice signal is supplied to the telephone unit 301
or the telephone network 302 via the line unit 303.
The application program continues to provide the
15   playback function until a playback end button on the
monitor is pressed by the user or the end of the data
stored in the memory is detected.
       However, in the above-described
conventional system, it is impossible for the
20   telephone user to start the playback processing by
using the telephone unit 301 to remotely control the
application program in the data processing device 304.
       Further, in the above-described
conventional system, when a telephone number entry
25   function, as one of the telephone services, is
obtained by executing the application program in the
data processing device 304, the user of the data
processing device 304 inputs a telephone number by
operating the input device. In this case, the
30   application program in the data processing device 304
stores the input telephone number in the memory. The
application program is executed to carry out the
telephone number entry processing when the user
operates the keyboard or the mouse in connection with
35   the monitor in an interactive manner.
       However, in the above-described
conventional system, it is impossible for the

1   telephone user to start the telephone number entry
processing by using the telephone unit 301 to remotely
control the application program in the data processing
device 304. It is impossible for the conventional
5   system to detect a telephone number input by the
telephone unit 301.

SUMMARY OF THE INVENTION

An object of the present invention is
10   to provide an improved communication support system in
which the above-mentioned problems are eliminated.

Another object of the present invention
is to provide a communication support system which
enables a user of a telephone unit to transmit a
15   command signal to a communication control device to
obtain a telephone service from a data processing
device while inhibiting transmission of a signal from
the telephone unit to the telephone network when the
data processing device is remotely controlled by the
20   telephone user.

Still another object of the present
invention is to provide a communication control device
for a communication support system including a
telephone unit, a telephone network and a data
25   processing device, which enables a user of the
telephone unit to transmit a command signal to the
communication control device to obtain a telephone
service from the data processing device while
inhibiting transmission of a signal from the telephone
30   unit to the telephone network when the data processing
device is remotely controlled by the telephone user.

A further object of the present
invention is to provide a method of executing a
telephone service processing in a communication
35   support system, which enables a user of a telephone
unit to transmit a command signal to a communication
control device to obtain a telephone service from a

data processing device while inhibiting transmission
of a signal from the telephone unit to a telephone
network when the data processing device is remotely
controlled by the telephone user.

Another object of the present invention
is to provide a computer readable medium storing
program code instructions which causes a processor to
execute a telephone service processing in a
communication support system in response to a command
signal sent by a telephone unit while inhibiting
transmission of a signal from the telephone unit to a
telephone network when a data processing device is
remotely controlled by the telephone user.

The above-mentioned objects of the
present invention are achieved by a communication
support system adapted to connect a telephone unit
through a communication control device to a data
processing device and adapted to connect a telephone
network to the communication control device, the
communication support system comprising: a command
signal recognition unit which discretely detects a
command signal sent by the telephone unit and a
command signal sent from the telephone network, and
determines whether the command signal from the
telephone unit is detected, the command signal from
the telephone unit indicating one of a plurality of
telephone services of the data processing device; a
signal transmission inhibition unit which inhibits
transmission of a signal from the telephone unit to
the telephone network; and a telephone service
processing unit which performs a telephone service
processing of the data processing device for the
telephone service indicated by the command signal from
the telephone unit, the telephone service processing
unit starting execution of the telephone service
processing when the command signal recognition unit
determines that the command signal from the telephone

1   unit is detected.

The above-mentioned objects of the
present invention are achieved by a communication
control device adapted to connect a telephone unit and
5   a data processing device through the communication
control device and adapted to connect a telephone
network to the communication control device, the
communication control device comprising: a line
switching unit which selectively provides one of
10   connection of the telephone unit and the telephone
network through the line switching unit and
disconnection of the telephone network from the
telephone unit; a command signal recognition unit
which discretely detects a command signal sent by the
15   telephone unit and a command signal sent from the
telephone network, and determines whether the command
signal from the telephone unit is detected, the
command signal from the telephone unit indicating one
of a plurality of telephone services of the data
20   processing device; and a signal transmission
inhibition unit which inhibits transmission of a
signal from the telephone unit to the telephone
network by controlling the line switching unit.

The above-mentioned objects of the
25   present invention are achieved by a method of
executing a telephone service processing in a
communication support system which is adapted to
connect a telephone unit through a communication
control device to a data processing device and adapted
30   to connect a telephone network to the communication
control device, the method comprising the steps of:
discretely detecting a command signal sent by the
telephone unit and a command signal sent from the
telephone network; determining whether the command
35   signal from the telephone unit is detected, the
command signal from the telephone unit indicating one
of a plurality of telephone services of the data

processing device; inhibiting transmission of a signal from the telephone unit to the telephone network; and starting execution of a telephone service processing of the data processing device for the telephone service indicated by the command signal from the telephone unit when it is determined in said determining step that the command signal from the telephone unit is detected.

The above-mentioned objects of the present invention are achieved by a computer readable medium storing program code instructions which cause a processor to execute a telephone service processing in a communication support system adapted to connect a telephone unit through a communication control device to a data processing device and adapted to connect a telephone network to the communication control device, the computer readable medium comprising: a first program code unit which causes the processor to discretely detect a command signal sent by the telephone unit and a command signal sent from the telephone network; a second program code unit which causes the processor to determine whether the command signal from the telephone unit is detected, the command signal from the telephone unit indicating one of a plurality of telephone services of the data processing device; a third program code unit which causes the processor to inhibit transmission of a signal from the telephone unit to the telephone network; and a fourth program code unit which causes the processor to start execution of a telephone service processing of the data processing device for the telephone service indicated by the command signal from the telephone unit when it is determined by said third program code means that the command signal from the telephone unit is detected.

In the communication support system of the present invention, it is possible for the

1   telephone user to easily obtain a computer-assisted
     telephone service from the data processing device by
     transmitting a command signal from the telephone unit
     to the communication control device regardless of
5   whether a telephone call between the telephone unit
     and the telephone network is in progress or not. In
     the communication support system of the present
     invention, the command signal recognition unit
     discretely detects a command signal sent by the
10   telephone unit and a command signal sent from the
     telephone network, and the signal transmission
     inhibition unit inhibits the transmission of a signal
     from the telephone unit to the telephone network.
     Therefore, the communication support system of the
15   present invention can provide adequate security of the
     telephone service of the data processing device for
     the telephone user, and can safely prevent erroneous
     execution of the telephone service processing of the
     data processing device as well as erroneous execution
20   of another processing of a remote system in the
     telephone network.
          The communication support system of the
     present invention can correctly determine whether a
     command signal from the telephone unit is locally
25   supplied to the communication control device or a
     command signal from the telephone network is remotely
     supplied. The communication support system of the
     present invention allows the telephone user to easily
     transmit data to or receive data from other
30   communication media such as the data processing
     device. Further, the communication support system of
     the present invention allows the telephone user to use
     a cordless telephone to remotely control the data
     processing device. It is not necessary that the user
35   be located in front of the data processing device when
     obtaining the computer-assisted telephone services
     from the communication support system.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will be more apparent from the following detailed description when read in conjunction with the accompanying drawings in which:

FIG. 1 is a block diagram of a communication support system of the present invention;

FIG. 2 is a diagram for explaining allocation of defined values to DTMF command signals;

FIG. 3 is a diagram for explaining a construction of elements of the communication support system;

FIG. 4 is a diagram for explaining another construction of elements of the communication support system;

FIG. 5 is a diagram for explaining still another construction of elements of the communication support system;

FIG. 6 is a diagram for explaining a further construction of elements of the communication support system;

FIG. 7 is a diagram for explaining another construction of elements of the communication support system;

FIG. 8 is a block diagram of one embodiment of the communication control device in the communication support system;

FIG. 9 is a flowchart for explaining a main routine of a telephone service processing executed by a central processing unit of the communication control device of FIG. 8;

FIG. 10 is a flowchart for explaining a PC interface initialization in the main routine of FIG. 9;

FIG. 11 is a flowchart for explaining a

CCD initialization in the main routine of FIG. 9;

FIG. 12 is a flowchart for explaining a
portion of a CCD control processing routine in the
main routine of FIG. 9;

FIG. 13 is a flowchart for explaining
the remaining portion of the CCD control processing
routine;

FIG. 14 is a flowchart for explaining
an on-hook processing in the CCD control processing
routine of FIGs. 12 and 13;

FIG. 15 is a flowchart for explaining a
DTMF processing and a DTMF notification in the CCD
control processing routine of FIGs. 12 and 13;

FIG. 16 is a flowchart for explaining a
defined value comparison processing in the CCD control
processing routine of FIGs. 12 and 13;

FIG. 17 is a flowchart for explaining a
coincidence processing in the CCD control processing
routine of FIGs. 12 and 13;

FIG. 18 is a flowchart for explaining
an interrupt processing executed by the central
processing unit of the communication control device of
FIG. 8;

FIG. 19 is a flowchart for explaining a
detection signal reading in the CCD control processing
routine of FIGs. 12 and 13; and

FIG. 20 is a block diagram of a
conventional communication support system.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A description will now be given of the
preferred embodiments of the communication support
system of the present invention with reference to the
accompanying drawings.

FIG. 1 shows a communication support
system of the present invention.

As shown in FIG. 1, the communication

support system generally has a telephone unit (TU) 1,
a communication control device (CCD) 2, a data
processing device (DPD) 3, and a telephone network
(TN) 4. The communication support system is adapted
to connect the telephone unit 1 through the
communication control device 2 to the data processing
device 3, and adapted to connect the telephone network
4 to the communication control device 2.

The telephone unit 1 provides existing
voice transmission and reception functions and an
existing dialing function. The telephone network 4
is, for example, a public switched telephone network.

The communication control device (CCD)
2 generally has a line switching unit 5, a command
signal recognition unit 6, and a signal transmission
inhibition unit 8. The line switching unit 5
selectively provides one of connection of the TU 1 and
the TN 4 through the line switching unit 5 and
disconnection of the TN 4 from the TU 1. Therefore,
the communication control device (CCD) 2 selectively
provides connection of the TU 1 to the TN 4 and
connection of the DPD 3 to the TN 4 through the line
switching unit 5.

In the communication control device 2,
the command signal recognition unit 6 discretely
detects a DTMF (dual-tone multiple frequency) command
signal sent by the TU 1 and a DTMF command signal sent
from the TN 4. The command signal recognition unit 6
determines whether the DTMF command signal is from the
TU 1, the DTMF command signal from the TU 1 indicating
one of a plurality of telephone services of the DPD 3.
The signal transmission inhibition unit 8 inhibits
transmission of a DTMF signal from the TU 1 to the TN
4 by controlling the line switching unit 5.

In the communication support system of
FIG. 1, the data processing device (DPD) 3 includes a
telephone service processing unit 7. The telephone

1   service processing unit 7 performs a telephone service
     processing of the DPD 3 for the telephone service
     indicated by the DTMF command signal from the TU 1.
     The telephone service processing unit 7 starts
5   execution of the telephone service processing when the
     command signal recognition unit 6 of the CCD 2 has
     determined that the DTMF command signal is from the TU
     1.
             In the communication support system of
10   FIG. 1, when power is not supplied to the CCD 2, the
     line switching unit 5 connects the TU 1 and the TN 4.
     When power is supplied to the CCD 2, the line
     switching unit 5 connects the TU 1 through the CCD 2
     to the DPD 3 and disconnects the TN 4 from the CCD 2.
15   At this time, the TU 1 is connected through the line
     switching unit 5 to the signal transmission inhibition
     unit 8. The command signal recognition unit 6
     discretely detects a DTMF command signal sent by the
     TU 1 and a DTMF command signal sent from the TN 4.
20   The command signal recognition unit 6 determines
     whether the DTMF command signal is from the TU 1, the
     DTMF command signal from the TU 1 indicating one of
     the plurality of telephone services of the DPD 3.
     When the DTMF command signal from the TU 1 is
25   detected, the command signal recognition unit 6
     notifies the telephone service processing unit 7 of
     the DPD 3 that the DTMF command signal from the TU 1
     is detected in the CCD 2. The telephone service
     processing unit 7 starts execution of a telephone
30   service processing of the DPD 3 for the telephone
     service indicated by the DTMF command signal from the
     TU 1.
             In the communication support system of
     FIG. 1, it is possible for the telephone user to
35   easily obtain a computer-assisted telephone service
     from the DPD 3 by transmitting a command signal from
     the TU 1 to the CCD 2 regardless of whether a

1   telephone call between the TU 1 and the TN 4 is in
     progress or not.   In the communication support system
     of the present invention, the command signal
     recognition unit 6 discretely detects a command signal
5   sent by the TU 1 and a command signal sent from the TN
     4, and the signal transmission inhibition unit 8
     inhibits the transmission of a signal from the TU 1 to
     the TN 4.   Therefore, the communication support system
     of FIG. 1 can provide adequate security of the
10   telephone service of the DPD 3 for the telephone user,
     and can safely prevent erroneous execution of the
     telephone service processing of the DPD 3 as well as
     erroneous execution of another processing of a remote
     system in the TN 4.
15   The communication support system of
     FIG. 1 can correctly determine whether a command
     signal from the TU 1 is locally supplied to the CCD 2
     or a command signal from the TN 4 is remotely
     supplied.   The communication support system of FIG. 1
20   allows the telephone user to easily transmit data to
     or receive data from other communication media such as
     the DPD 3.   Further, the communication support system
     of FIG. 1 allows the telephone user to use a cordless
     telephone to remotely control the DPD 3.   It is not
25   necessary that the user be located in front of the DPD
     3 when obtaining the computer-assisted telephone
     services from the communication support system.
            FIG. 2 shows an allocation table in
     which defined values are allocated to DTMF command
30   signals which correspond to a plurality of telephone
     services of the data processing device in the
     communication support system of the present invention.
            In the communication support system of
     the present invention, a DTMF (dual-tone multiple
35   frequency) pulse is used by the telephone unit (TU) to
     transmit a command signal to the communication control
     device (CCD).   More specifically, as shown in FIG. 2,

defined values related to a ten-key pad ("0"-"9", "#"
and "*") of the telephone unit are allocated to a
plurality of DTMF command signals corresponding to the
plurality of telephone services of the data processing
device (DPD). The defined values may be suitably
selected from those that are not ordinarily used to
indicate a telephone number of a destination terminal
in the telephone network. The defined values used by
the communication support system of the present
invention include, for examples, "*1" through "*4" and
"*7" through "*9" as shown in FIG. 2.

According to the allocation table of
FIG. 2, a DTMF command signal sent by the telephone
unit (TU) is detected by the communication control
device (CCD). The DTMF command signal indicates a
specific one of the plurality of telephone services.
As shown in FIG. 2, the plurality of telephone
services provided by the data processing device (DPD)
in the communication support system of the present
invention include, for example, voice recording start
("*1"), voice recording end ("*2"), voice playback
start ("*3"), voice playback end ("*4"), file
transmission start ("*7"), file transmission end
("*8"), and telephone number entry ("*9"). In the
communication control device (CCD), it is possible to
determine which of the plurality of telephone services
is indicated by the DTMF command signal sent by the
telephone unit (TU).

Alternatively, in a case in which a
dial pulse is used by the telephone unit 1 to transmit
a command signal to the communication control device
2, other defined values related to the ten-key pad of
the telephone unit 1 may be allocated to a plurality
of dial-pulse command signals instead of the example
of FIG. 2. In such a case, the plurality of dial-
pulse command signals respectively correspond to the
plurality of telephone services.

In addition, in the case of the DTMF pulse used by the telephone unit (TU) 1 to transmit a command signal to the communication control device (CCD) 2, a plurality of specifically-designed keys ("A", "B", ...) of the telephone unit 1 may be allocated to the plurality of DTMF command signals, instead of the ten-key pad of the telephone unit 1. In such a case, the plurality of specifically designed keys respectively correspond to the plurality of telephone services.

In the communication support system of the present invention, as shown in FIG. 1, the communication control device 2 may be considered a modem or a terminal adapter that connects both the telephone unit 1 and the data processing device 3 to the telephone network 4. FIG. 3 through FIG. 7 show various examples of construction of the elements of the communication support system. In the examples of FIGs. 3-7, a modem, a telephone system having a built-in modem, and a personal computer having a built-in telephone and modem are used to construct the communication support system of the present invention.

The examples of FIG. 3 and FIG. 4 have a construction that is essentially the same as the construction of the elements of the communication support system of FIG. 1. In the examples of FIG. 3 and FIG. 4, a modem 41 is substituted for the communication control device 2 in the communication support system of the present invention. In the example of FIG. 4, the telephone unit 1 includes a radio circuit 11 and a cordless telephone 12. The cordless telephone 12 provides existing radio signal transmission and reception functions at a remote location of the radio circuit 11. The radio circuit 11 provides conversion of a radio signal from the cordless telephone 12 into voice data and conversion of voice data from the telephone line into a radio

1   signal.

The example of FIG. 5 utilizes a
telephone system 42 having a built-in modem. In this
example, the modem 41 contained in the telephone
5   system 42 is substituted for the communication control
device 2 in the communication support system of the
present invention.

The example of FIG. 6 utilizes a
telephone system 43 having a built-in modem. In the
10   example of FIG. 6, the modem 41 contained in the
telephone system 43 is substituted for the
communication control device 2 in the communication
support system of the present invention. Also, the
radio circuit 11 in the telephone system 43 forms a
15   part of the communication control device 2, and the
cordless telephone 12 is substituted for the telephone
unit 1.

The example of FIG. 7 utilizes a
personal computer 44 having a built-in telephone and a
20   built-in modem. In the example of FIG. 7, the modem
41 and the data processing device 3, contained in the
personal computer 44, are substituted for the
communication control device 2 and the data processing
device 3 in the communication support system of the
25   present invention. Also, the radio circuit 11 in the
personal computer 44 forms a part of the communication
control device 2, and the cordless telephone 12 is
substituted for the telephone unit 1.

Next, FIG. 8 shows one embodiment of
30   the communication control device in the communication
support system of the present invention.

In the present embodiment, one of the
telephone services, including the voice recording and
playback, file transmission and telephone number
35   entry, is provided when the user of the telephone unit
transmits a DTMF command signal from the telephone
unit to the communication control device to remotely

1   control the data processing device.

As shown in FIG. 8, the communication
support system generally has a telephone unit (TU)
101, a communication control device (CCD) 200, a data
5   processing device (DPD) 115, and a telephone network
(TN) 102. The communication support system is adapted
to connect the TU 101 through the CCD 200 to the DPD
115, and adapted to connect the TN 102 to the CCD 200.
A PC interface unit (PC/I) 114 is provided between the
10   CCD 200 and the DPD 115.

The CCD 200 in the present embodiment
comprises a relay 103, a relay control unit 104, a 2-
line/4-line converter unit 105, a 2-line/4-line
converter unit 106, a DTMF detection unit 107, a data
15   modulator/demodulator unit (DATA MODEM) 108, a DTMF
detection unit 109, a signal detection unit 110, a
DTMF generator unit 111, a central processing unit
(CPU) 112, a bus 113, a direct-current (DC) detection
unit 116, a direct-current (DC) detection unit 117,
20   and a switch (SW) 118.

In the above-described communication
support system, the execution of one of the telephone
services, including voice recording and playback, file
transmission and telephone number entry, is requested
25   of the DPD 115 by the CCD 200 based on a corresponding
one of the plurality of DTMF command signals sent from
the telephone unit 101.

The TU 101 provides the existing voice
signal transmission and receiving functions and the
30   existing dialing function. The TU 101 transmits a
DTMF command signal to the CCD 200 to remotely control
the DPD 115. The TN 102 is, for example, a public
switched telephone network. The user of the TU 101
may communicate with a person of a destination
35   terminal over the TN 102 by voice.

The CPU 112 receives signals from the
elements of the CCD 200 connected through the bus 113,

1   performs control processing based on the received
     signals, and controls the elements of the CCD 200.
     The DC detection unit 117 provides detection of an on-
     hook condition of the TU 101. The DC detection unit
5   116 provides detection of a disconnection of the TN
     102 from the CCD 200.
               In the CCD 200 of the present
     embodiment, a telephone service processing related to
     the flowcharts of FIGs. 9-19 (which will be described
10   later) is program code instructions stored in a memory
     (not shown) of the CCD 200. The memory of the CCD 200
     is, for example, a ROM (read-only memory). The memory
     corresponds to a processor readable medium in the
     claims. The processor readable medium may be any one
15   of instruction storage devices, such as, for example,
     magnetic disks including floppy disks, optical disks
     including CD-ROMs, magneto-optical disks including
     MOs, semiconductor memory cards, such as PC cards and
     miniature cards, and other types of computer usable
20   devices and media.
               Further, in the present embodiment, the
     memory of the CCD 200 may store encoded or non-encoded
     instructions. The instructions may be installed from
     a floppy disk (or a CD-ROM) to a hard disk drive (not
25   shown) of the CCD 200 first, transferred to a RAM (not
     shown) of the CCD 200 and then read by the CPU 112.
     The memory of the CCD 200 may store either all or a
     part of the instructions related to the flowcharts of
     FIGs. 9-19.
30   The relay control unit 104 controls the
     relay 103 under the control of the CPU 112. The relay
     103 switches on or off a connection line between the
     TU 101 and the TN 102 when the relay 103 is controlled
     by the relay control unit 104. In the present
35   embodiment, when power is supplied to place the CCD
     200 in an initial condition, the relay 103 is set in
     an off-state by the relay control unit 104 so that the

1   TU 101 is disconnected from the TN 102. When a control signal from the CPU 112 is sent to the relay control unit 104, or when power is not supplied to the CCD 200, the relay 103 is set in an on-state by the

5   relay control unit 104 so that the TU 101 is connected to the TN 102 through the relay 103.

         The 2-line/4-line converter unit 105 separates a data signal sent from the TN 102 into a DTMF signal and a voice signal. Similarly, the 2-

10   line/4-line converter unit 106 separates a data signal sent by the TU 101 into a DTMF signal and a voice signal. Also, the 2-line/4-line converter unit 106 supplies power to the CCD 200.

         The DTMF detection unit 107 provides

15   detection of a DTMF signal sent by the TN 102. The DTMF detection unit 109 provides detection of a DTMF signal (including the DTMF command signal) sent by the TU 101. The DATA MODEM 108 provides modulation and demodulation of the voice signal on the line from the

20   TN 102 or the line from the TU 101.

         The signal detection unit 110 provides detection of various signals sent from or to the telephone line (the TU 101 and the TN 102), the signals including a busy-tone signal, a ring-tone

25   signal, a ring-back-tone signal, an on-hook signal, and an off-hook signal. The busy-tone signal, when detected by the signal detection unit 110, indicates that a telephone call between the TU 101 and the TN 102 is in progress. The ring-tone signal, when

30   detected by the signal detection unit 110, indicates that a call from a telephone in the TN 102 is being received by the TU 101. The ring-back-tone signal, when detected by the signal detection unit 110, indicates that a telephone call from the TU 101 is

35   being received by a telephone in the TN 102.

         The DTMF generator unit 111 generates a DTMF signal (indicating a telephone number) under

control of the CPU 112, and transmits the DTMF signal from the CCD 200 to the TN 102.

The PC interface unit 114 provides a personal-computer interface to connect the CCD 200 and the DPD 115. The DPD 115 provides execution of the telephone service processing in order to provide the telephone service for the user of the TU 101.

The switch 118 switches on or off a connection line of the converter unit 105 and the converter unit 106 under control of the CPU 112, and switches on or off a connection line of the converter unit 105 and the DTMF generator unit 111 under control of the CPU 112. When a telephone call between the TU 101 and the TN 102 is in progress, the switch 118 switches on the connection line of the converter unit 105 and the converter unit 106 in order to connect the TU 101 and the TN 102, and switches off the connection line of the converter unit 105 and the DTMF generator unit 111. When a DTMF command signal from the TU 101 is detected, the switch 118 switches off the connection line of the converter unit 105 and the converter unit 106 in order to disconnect the TN 102 from the TU 101. When a DTMF signal (indicating a telephone number) from the CCD 200 is transmitted to the TN 102 in order to transmit a telephone call, the switch 118 switches on the connection line of the converter unit 105 and the DTMF generator unit 111 in order to connect the DTMF generator unit 111 and the TN 102.

Next, a description will be given of an operation of the communication support system of the above-described embodiment of FIG. 8 when a telephone call between the TU 101 and the TN 102 is not in progress.

In the communication support system of FIG. 8, when a telephone call between the TU 101 and the TN 102 is not in progress, the switch 118 is

1   controlled by the CPU 112 so that the switch 118 switches off the connection line of the converter unit 105 and the converter unit 106 to disconnect the TN 102 from the TU 101. At this time, in the

5   communication support system of FIG. 8, power is supplied to the CCD 200, and the relay 103 is set in the off-state by the relay control unit 104.

When the communication support system of FIG. 8 is placed in the above-mentioned condition,

10   the user of the TU 101 transmits a DTMF command signal from the TU 101 to the CCD 200 to remotely control the DPD 115 and obtain a desired telephone service of the DPD 115. In the CCD 200, the DTMF detection unit 109 detects the DTMF command signal sent by the TU 101.

15   The CPU 112 is notified that the DTMF command signal from the TU 101 is detected by the DTMF detection unit 109. Then, the CPU 112 notifies the DPD 115 that an event has occurred in the CCD 200 due to the DTMF command signal sent by the TU 101.

20   When the DPD 115 is notified that the event has occurred due to the DTMF command signal sent by the TU 101, a telephone service application program provided in the DPD 115 is performed by the DPD 115 based on the content of the DTMF command signal, so

25   that the desired telephone service of the DPD 115 is provided for the user of the TU 101.

In the communication support system of FIG. 8, the user of the TU 101 presses either the ten-key pad or one of the specifically-designed keys of

30   the TU 101 to transmit a DTMF command signal (indicating one of the defined values) to the DPD 115. Since the DTMF command signal sent by the TU 101 indicates a specific one of the defined values for the plurality of telephone services, it is possible for

35   the CCD 200 to distinguish the DTMF command signal (indicating one of the defined values) from a different DTMF signal (indicating a telephone number

1   of a destination terminal). Erroneous execution of
the telephone service processing by the DPD 115 in
response to the different DTMF signal can be avoided.
It is possible to provide the telephone service of the
5   DPD 115 for the telephone user when the telephone call
between the TU 101 and the TN 102 is not in progress
and the telephone user transmits a DTMF command signal
from the TU 101 to remotely control the DPD 115.

On the other hand, in the communication
10   support system of FIG. 8, when the switch 118 is set
in the off-state of the connection line of the
converter unit 105 and the converter unit 106, the
user of the TU 101 transmits a DTMF signal (which
indicates a telephone number of a destination terminal
15   and is different from the DTMF command signal) through
the CCD 200 to the TN 102 in order to transmit a
telephone call to a destination terminal in the TN
102. At this time, the switch 118 is controlled by
the CPU 112 so that the switch 118 switches on the
20   connection line of the converter unit 105 and the DTMF
generator unit 111 to connect the DTMF generator unit
111 and the TN 102. The DTMF generator unit 111
generates a DTMF signal based on the content of the
DTMF signal sent by the TU 101, and transmits the
25   generated DTMF signal from the CCD 200 to the TN 102.
After the DTMF signal (indicating the telephone
number) is transmitted to the TN 102, the DTMF
generator unit 111 notifies the CPU 112 that the
transmission of the DTMF signal has ended. Then the
30   switch 118 is controlled by the CPU 112 so that the
switch 118 switches off the connection line of the
converter unit 105 and the DTMF generator unit 111.
Therefore, the CPU 112 inhibits transmission of a DTMF
signal from the TU 101 to the TN 102.
35   In the communication support system of
FIG. 8, the DTMF detection unit 109 provides not only
detection of a DTMF command signal (indicating one of

the defined values) sent by the TU 101 but also
detection of a different DTMF signal (indicating a
telephone number) sent by the TU 101.

Next, a description will be given of an
5   operation of the communication support system of the
above-described embodiment of FIG. 8 when a telephone
call between the TU 101 and the TN 102 is in progress.

When the telephone call from the TU 101
is received by the destination terminal in the TN 102,
10   a ring-back-tone signal from the TN 102 is sent to the
CCD 200. In the CCD 200, the ring-back-tone signal is
detected by the signal detection unit 110. The signal
detection unit 110 notifies the CPU 112 that the ring-
back-tone signal from the TN 102 is detected. The
15   switch 118 is controlled by the CPU 112 so that the
switch 118 switches on the connection line of the
converter unit 105 and the converter unit 106 to
connect the TN 102 and the TU 101. When the CCD 200
is placed in this condition, the telephone call
20   between the TU 101 and the TN 102 is in progress and
the user of the TU 101 can communicate with a person
of the destination terminal over the TN 102 by voice.

During the telephone call between the
TU 101 and the TN 102, the user of the TU 101
25   transmits a DTMF command signal from the TU 101 to the
CCD 200, and the DTMF command signal from the TU 101
is detected by the DTMF detection unit 109. The DTMF
detection unit 109 notifies the CPU 112 that the DTMF
command signal sent by the TU 101 is detected. The
30   switch 118 is controlled by the CPU 112 so that the
switch 118 switches off the connection line of the
converter unit 105 and the converter unit 106 to
disconnect the TN 102 from the TU 101. Therefore, the
CPU 112 inhibits transmission of a DTMF signal from
35   the TU 101 to the TN 102 through the switch 118. The
CPU 112 notifies the DPD 115 that an event has
occurred in the CCD 200 due to the DTMF command signal

1   sent by the TU 101.

When the DPD 115 is notified that the
event has occurred due to the DTMF command signal sent
by the TU 101, a telephone service processing program
5   in the DPD 115 is executed by the DPD 115 based on the
content of the DTMF command signal, so that the
desired telephone service of the DPD 115 is provided
for the user of the TU 101. Therefore, it is possible
to provide the telephone service of the DPD 115 for
10   the telephone user even when the telephone call
between the TU 101 and the TN 102 is in progress and
the telephone user transmits a DTMF command signal
from the TU 101 to remotely control the DPD 115.

On the other hand, in the communication
15   support system of FIG. 8, when the telephone call
between the TU 101 and the TN 102 is in progress, a
person of the destination terminal in the TN 102 may
transmit a DTMF command signal (or a different DTMF
signal) to the CCD 200. At this time, the DTMF signal
20   from the TN 102 is detected by the DTMF detection unit
107. The DTMF detection unit 107 notifies the CPU 112
that the DTMF signal sent from the TN 102 is detected.
The CPU 112 notifies the DPD 115 that an event has
occurred in the CCD 200 due to the DTMF signal sent
25   from the TN 102. The DPD 115 executes an invalid-
access prevention processing program (different from
the telephone service processing program) in the DPD
115 based on the content of the DTMF signal sent from
the TN 102, so that a warning message from the DPD 115
30   is provided for the person of the destination terminal
in the TN 102.

In the communication support system of
FIG. 8, it is possible to correctly distinguish
between the DTMF signal (indicating either one of the
35   defined values or a telephone number) from the TU 101
and a different DTMF signal from the TN 102.
Erroneous execution of the telephone service

1   processing program by the DPD 115 due to the different DTMF signal is avoided. It is possible to provide adequate security of the telephone service of the DPD 115 for the telephone user.

5   Next, FIG. 9 shows a main routine of a telephone service processing program executed by the CPU 112 of the CCD 200 of FIG. 8 to remotely control the DPD 115 and obtain a desired telephone service of the DPD 115. FIG. 10 shows a PC interface initializa-

10   tion in the main routine of FIG. 9. FIG. 11 shows a CCD initialization in the main routine of FIG. 9.

    In the main routine of FIG. 9, power is supplied to the CCD 200 upon start-up, and the program code instructions, stored in the memory of the CCD

15   200, cause the CPU 112 to perform an initialization of the CCD 200 (S1). After the CCD initialization of the above S1 is performed, the program code instructions cause the CPU 112 to perform an initialization of the PC interface 114 (S2). After the PC interface

20   initialization of the above S2 is performed, the program code instructions cause the CPU 112 to perform a CCD control processing routine (S3) based on a signal sent by the TU 101, which will be described later.

25   As shown in FIG. 11, during the CCD initialization, the program code instructions cause the CPU 112 to initialize all internal flags of the CCD 200 (S11). After the initialization of the internal flags of the above S11 is performed, the

30   program code instructions cause the CPU 112 to set the relay 103 in the on-state by controlling the relay control unit 104 (S12). In this case, the relay 103 switches on the connection line of the TU 101 and the TN 102 so that the TU 101 is connected through the CCD

35   200 to the TN 102. After the setting of the relay 103 of the above S12 is performed, the CCD initialization of FIG. 11 is finished.

As shown in FIG. 10, during the PC
interface initialization, the program code
instructions cause the CPU 112 to set a status portion
of the memory of the CCD 200 at a predetermined value
(S21). After the setting of the status portion of the
above S21 is performed, the program code instructions
cause the CPU 112 to set a data portion of the memory
of the CCD 200 at "00" (S22). After the setting of
the data portion of the above S22 is performed, the
program code instructions cause the CPU 112 to set a
data strobe signal in an on-state (S23). After a
given time period, the program code instructions cause
the CPU 112 to set the data strobe signal in an off-
state (S23). In this case, setting the status portion
at the predetermined value indicates that data is
currently included in the data portion of the memory.
After the setting of the data strobe signal of the
above S23 is performed, the PC interface
initialization of FIG. 10 is finished.

As described above, in the CCD 200 of
the communication support system of FIG. 8, when power
is supplied to place the CCD 200 in the initial
condition, the relay 103 is set in the off-state by
the relay control unit 104 so that the TN 102 is
disconnected from the TU 101.

During the main routine of FIG. 9, the
CPU 112 of the CCD 200 executes an interrupt
processing routine in response to an interrupt signal,
and the execution of the interrupt processing routine
occurs simultaneously with the execution of the main
routine of FIG. 9. In the communication support
system of the present embodiment, the interrupt signal
is supplied to the CPU 112 by either the DPD 115 or
the CCD 200, which causes the interrupt processing
routine to be executed. In the CCD 200, the DTMF
detection unit 107, the DTMF detection unit 109, or
the signal detection unit 110 supplies a detection

signal to the CPU 112 as the interrupt signal which
causes the execution of the interrupt processing
routine. The DPD 115 supplies a control command to
the CPU 112 as the interrupt signal which causes the
execution of the interrupt processing routine, and
this control command includes a defined value
comparison mode setting command, a defined value
comparison mode resetting command, a DTMF command
transmission setting command, a secret number setting
command, and a line switching command.

FIG. 18 shows the interrupt processing
routine executed by the CPU 112 of the CCD 200.

As shown in FIG. 18, when an interrupt
signal is received by the CPU 112, the program code
instructions cause the CPU 112 to determine whether
the interrupt has occurred due to a control command
sent by the DPD 115 (S161).

When the interrupt has occurred due to
the control command from the DPD 115 (the result of
the above S161 is affirmative), the program code
instructions cause the CPU 112 to determine whether
the control command sent by the DPD 115 is a defined
value comparison mode setting command (S164). When
the result of the above S164 is affirmative, the
program code instructions cause the CPU 112 to set the
CCD 200 in a defined value comparison mode (S165).
After the setting of the CCD 200 of the above S165 is
performed, the interrupt processing routine of FIG. 18
is finished.

When the control command sent by the
DPD 115 is not the defined value comparison mode
setting command (the result of the above S164 is
negative), the program code instructions cause the CPU
200 to determine whether the control command is a
defined value comparison mode resetting command
(S166). When the result of the above S166 is
affirmative, the program code instructions cause the

CPU 112 to set the CCD 200 in a non-comparison mode (S167). After the setting of the CCD 200 of the above S167 is performed, the interrupt processing routine of FIG. 18 is finished.

When the control command sent by the DPD 115 is not the defined value comparison mode resetting command (the result of the above S166 is negative), the program code instructions cause the CPU 112 to determine whether the control command sent by the DPD 115 is a DTMF command transmission setting command (S168). When the result of the above S168 is affirmative, the program code instructions cause the CPU 112 to store the content of the DTMF command signal in the memory of the CCD 200 (S169). When the DTMF command transmission setting command is received, the CCD 200 transmits the content of the DTMF command signal, stored in the memory of the CCD 200, to the DPD 115. After the storing of the DTMF command signal of the above S169 is performed, the interrupt processing routine of FIG. 18 is finished.

When the control command sent by the DPD 115 is not the DTMF command transmission setting command (the result of the above S168 is negative), the program code instructions cause the CPU 200 to determine whether the control command is a secret number setting command (S170). When the result of the above S170 is affirmative, the program code instructions cause the CPU 112 to store the content of the control command in the memory of the CCD 200 as the secret number (S171). After the storing of the secret number of the above S171 is performed, the interrupt processing routine of FIG. 18 is finished.

When the control command sent by the DPD 115 is not the secret number setting command (the result of the above S170 is negative), the program code instructions cause the CPU 200 to determine whether the control command is a line switching

command (S172). When the result of the above S172 is
affirmative, the program code instructions cause the
CPU 112 to control the switch 118 so that the switch
118 switches on the connection line of the converter
unit 105 and the converter unit 106 to connect the TN
102 and the TU 101 (S173). After the above S173 is
performed, the program code instructions cause the CPU
112 to set a coincidence processing end signal (S174).
After the setting of the coincidence processing end
signal of the above S174 is performed, the interrupt
processing routine of FIG. 18 is finished.

When the command signal sent by the DPD
115 is none of the above-mentioned commands (all the
results of the above S164, S166, S168, S170 and S172
are negative), the interrupt processing routine of
FIG. 18 is finished.

When the interrupt has occurred due to
a signal other than the control command from the DPD
115 (the result of the above S161 is negative), the
program code instructions cause the CPU 112 to
determine whether the interrupt has occurred due to a
detection signal sent by one of the DTMF detection
unit 107, the DTMF detection unit 109, and the signal
detection unit 110 (S162). When the result of the
above S162 is negative, the interrupt processing
routine of FIG. 18 is finished. When the result of
the above S162 is affirmative, the program code
instructions cause the CPU 112 to store the content of
the detection signal (or one of the DTMF command
signal, the busy-tone signal, the ring-tone signal,
ring-back-tone signal, the on-hook signal and the off-
hook signal) in the memory of the CCD 200 (S163).
After the storing of the detection signal of the above
S163 is performed, the interrupt processing routine of
FIG. 18 is finished.

The DPD 115 provides execution of the
telephone service processing in order to provide the

1   telephone service for the user of the TU 101 based on
    a previous stored condition and the DTMF command
    signal sent by the TU 101. The telephone service is,
    for example, one of the voice recording, the voice
5   playback, the file transmission, and the telephone
    number entry.
            When a detection signal from one of the
    DTMF detection unit 107, the DTMF detection unit 109,
    and the signal detection unit 110 is detected during
10 the interrupt processing routine of FIG. 18, the CPU
    112 of the CCD 200 performs the CCD control processing
    routine S3 in the main routine of FIG. 9.
            FIG. 12 and FIG. 13 show the CCD
    control processing routine S3 in the main routine of
15 FIG. 9. As described above, the PC interface
    initialization of FIG. 10 and the CCD initialization
    of FIG. 11 are already performed. The program code
    instructions cause the CPU 112 to perform the CCD
    control processing routine of FIGs. 12 and 13 when a
20 detection signal from one of the units 107, 109 and
    110 is detected during the interrupt processing
    routine of FIG. 18.
            As shown in FIG. 12, the program code
    instructions cause the CPU 112 to control the switch
25 118 so that the switch 118 switches off the connection
    line of the converter unit 105 and the converter unit
    106 to disconnect the TN 102 from the TU 101 (S101).
    After the above S101 is performed, the program code
    instructions cause the CPU 112 to perform a detection
30 signal reading (S102).
            FIG. 19 shows the detection signal
    reading in the CCD control processing routine of FIGs.
    12 and 13.
            As shown in FIG. 19, the program code
35 instructions cause the CPU 112 to read out the
    detection signal (which has been stored in the above
    S163 in the interrupt processing of FIG. 18) from the

memory of the CCD 200 (S69). After the reading of the
detection signal of the above S69 is performed, the
program code instructions cause the CPU 112 to
determine whether the detection signal can be actually
read out from the memory of the CCD 200 (S70). When
the result of the above S70 is negative, the detection
signal reading of FIG. 19 is finished.

When the result of the above S70 is
affirmative, the program code instructions cause the
CPU 112 to initialize a corresponding portion of the
memory of the CCD 200 in which the detection signal
was stored during the interrupt processing of FIG. 18
(S71). After the initialization of the above S71 is
performed, the program code instructions cause the CPU
112 to return a code indicating the content of the
detection signal read out in the above S69 (S72).
After the returning of the code of the above S72 is
performed, the detection signal reading of FIG. 19 is
finished.

Referring back to FIGs. 12 and 13,
after the detection signal reading S102 is performed,
the program code instructions cause the CPU 112 to
determine whether the off-hook signal is indicated by
the return code obtained by the detection signal
reading S102 (S103).

When the result of the above S103 is
negative, the program code instructions cause the CPU
112 to determine whether the ring-tone signal is
indicated by the return code obtained by the detection
signal reading S102 (S104).

When the result of the above S104 is
negative, the program code instructions cause the CPU
112 to return to the detection signal reading of the
above S102. The CPU 112 waits for a next detection
signal to be detected within the CCD 200 and read out
from the memory of the CCD 200 during the detection
signal reading of the above S102.

When the result of the above S104 is
affirmative, the program code instructions cause the
CPU 112 to set a corresponding portion of the memory
of the CCD 200 at a predetermined value, the
predetermined value indicating that the ring-tone
signal was previously stored in the memory of the CCD
200 (S105). After the above S105 is performed, the
program code instructions cause the CPU 112 to return
to the detection signal reading of the above S102.
The CPU 112 waits for a next detection signal to be
detected within the CCD 200 and read out from the
memory of the CCD 200 during the detection signal
reading of the above S102.

When the result of the above S103 is
affirmative, the program code instructions cause the
CPU 112 to determine whether the predetermined value
(indicating that the ring-tone signal was previously
stored in the memory of the CCD 200) is already set in
the corresponding portion of the memory of the CCD 200
(S106).

When the result of the above S106 is
negative, the program code instructions cause the CPU
112 to perform the detection signal reading of FIG. 19
(S107). The CPU 112 waits for a next detection signal
to be detected within the CCD 200 and read out from
the memory of the CCD 200 during the detection signal
reading of the above S107. On the other hand, when
the result of the above S106 is affirmative, the
program code instructions cause the CPU 112 to delete
the predetermined value (which has been stored in the
above S105) in the corresponding portion of the memory
of the CCD 200 (S112). After the above S112 is
performed, the program code instructions cause the CPU
112 to control the switch 118 so that the switch 118
switches on the connection line of the converter unit
105 and the converter unit 106 to connect the TU 101
and the TN 102 (S111).

After the control of the switch 118 of
the above S111 is performed, the program code
instructions cause the CPU 112 to perform the
detection signal reading of FIG. 19 (S121) as shown in
FIGs. 12 and 13. The CPU 112 waits for a next
detection signal to be detected within the CCD 200 and
read out from the memory of the CCD 200 during the
detection signal reading of the above S121.

After the detection signal reading of
the above S107 is performed, the program code
instructions cause the CPU 112 to determine whether
the DTMF signal (which is locally sent by the TU 101
and detected by the DTMF detection unit 109) is
indicated by the return code obtained by the detection
signal reading S107 (S108).

When the result of the above S108 is
affirmative, the program code instructions cause the
CPU 112 to perform a DTMF processing (S113). The DTMF
processing will be described later with reference to
FIG. 15. After the DTMF processing of the above S113
is performed, the program code instructions cause the
CPU 112 to return to the detection signal reading of
the above S107. The CPU 112 waits for a next
detection signal to be detected within the CCD 200 and
read out from the memory of the CCD 200 during the
detection signal reading of the above S107.

When the result of the above S108 is
negative, the program code instructions cause the CPU
112 to determine whether the on-hook signal is
indicated by the return code obtained by the detection
signal reading S107 (S109). When the result of the
above S109 is affirmative, the program code
instructions cause the CPU 112 to perform an on-hook
processing (S114). The on-hook processing will be
described later with reference to FIG. 14. After the
on-hook processing of the above S114 is performed, the
program code instructions cause the CPU 112 to return

to the above S101.

When the result of the above S109 is negative, the program code instructions cause the CPU 112 to determine whether the ring-back-tone signal is indicated by the return code obtained by the detection signal reading S107 (S110). When the result of the above S110 is negative, the program code instructions cause the CPU 112 to return to the detection signal reading of the above S107. The CPU 112 waits for a next detection signal to be detected within the CCD 200 and read out from the memory of the CCD 200 during the detection signal reading of the above S107.

When the result of the above S110 is affirmative, the program code instructions cause the CPU 112 to perform the above S111 in which the switch 118 is controlled by the CPU 112 so that the switch 118 switches on the connection line of the converter unit 105 and the converter unit 106 to connect the TU 101 and the TN 102. After the control of the switch 118 of the above S111 is performed, the program code instructions cause the CPU 112 to perform the detection signal reading of the above S121. The CPU 112 waits for a next detection signal to be detected within the CCD 200 and read out from the memory of the CCD 200 during the detection signal reading of the above S121.

Referring to FIG. 13, after the detection signal reading S121 is performed, the program code instructions cause the CPU 112 to determine whether the on-hook signal is indicated by the return code obtained by the detection signal reading S121 (S122). When the result of the above S122 is affirmative, the program code instructions cause the CPU 112 to perform the on-hook processing (S133). The on-hook processing will be described later with reference to FIG. 14. After the on-hook processing of the above S133 is performed, the program

1 code instructions cause the CPU 112 to return to the
above S101.

When the result of the above S122 is
negative, the program code instructions cause the CPU
5 112 to determine whether the DTMF signal (which is
remotely sent from the TN 102 and detected by the DTMF
detection unit 107) is indicated by the return code
obtained by the detection signal reading S121 (S123).

When the result of the above S123 is
10 affirmative, the program code instructions cause the
CPU 112 to perform a DTMF notification (S124). The
DTMF notification processing will be described later
with reference to FIG. 15. After the DTMF
notification processing of the above S124 is
15 performed, the program code instructions cause the CPU
112 to return to the detection signal reading of the
above S121. The CPU 112 waits for a next detection
signal to be detected within the CCD 200 and read out
from the memory of the CCD 200 during the detection
20 signal reading of the above S121.

When the result of the above S123 is
negative, the program code instructions cause the CPU
112 to determine whether the DTMF signal (which is
locally sent by the TU 101 and detected by the DTMF
25 detection unit 109) is indicated by the return code
obtained by the detection signal reading S121 (S125).
When the result of the above S125 is negative, the
program code instructions cause the CPU 112 to return
to the detection signal reading of the above S121.
30 The CPU 112 waits for a next detection signal to be
detected within the CCD 200 and read out from the
memory of the CCD 200 during the detection signal
reading of the above S121.

When the result of the above S125 is
35 affirmative, the program code instructions cause the
CPU 112 to determine whether the CCD 200 is set in the
defined value comparison mode (S126). When the result

of the above S126 is negative, the program code
instructions cause the CPU 112 to return to the
detection signal reading of the above S121. The CPU
112 waits for a next detection signal to be detected
within the CCD 200 and read out from the memory of the
CCD 200 during the detection signal reading of the
above S121.

When the result of the above S126 is
affirmative, the program code instructions cause the
CPU 112 to perform a defined value comparison
processing (S127). The defined value comparison
processing will be described later with reference to
FIG. 16. After the defined value comparison
processing of the above S127 is performed, the program
code instructions cause the CPU 112 to determine
whether the defined value comparison processing has
normally ended (S128).

When the result of the above S128 is
negative, the program code instructions cause the CPU
112 to perform the detection signal reading of FIG. 19
(S129). The CPU 112 waits for a next detection signal
to be detected within the CCD 200 and read out from
the memory of the CCD 200 during the detection signal
reading of the above S129.

After the detection signal reading of
the above S129 is performed, the program code
instructions cause the CPU 112 to determine whether
the DTMF signal (which is locally sent by the TU 101
and detected by the DTMF detection unit 109) is
indicated by the return code obtained by the detection
signal reading S129 (S130).

When the result of the above S130 is
affirmative, the program code instructions cause the
CPU 112 to return to the defined value comparison
processing of the above S127. The defined value
comparison processing will be described later with
reference to FIG. 16.

1   When the result of the above S130 is negative, the program code instructions cause the CPU 112 to determine whether the on-hook signal is indicated by the return code obtained by the detection

5   signal reading S129 (S131). When the result of the above S131 is affirmative, the program code instructions cause the CPU 112 to perform the on-hook processing (S132). The on-hook processing will be described later with reference to FIG. 14. After the

10   on-hook processing of the above S132 is performed, the program code instructions cause the CPU 112 to return to the above S101.

        When the result of the above S131 is negative, the program code instructions cause the CPU

15   112 to return to the defined value comparison processing of the above S127.

        On the other hand, when the result of the above S128 is affirmative, the program code instructions cause the CPU 112 to determine whether

20   coincidence is indicated by a return code obtained by the defined value comparison processing S127 (S134). When the result of the above S134 is affirmative, the program code instructions cause the CPU 112 to perform a coincidence processing (S135). The coincidence

25   processing will be described later with reference to FIG. 17.

        After the coincidence processing of the above S135 is performed, the program code instructions cause the CPU 112 to determine whether the off-hook

30   signal is indicated by the return code obtained during the coincidence processing S135 (S136). When the result of the above S136 is affirmative, the program code instructions cause the CPU 112 to return to the above S101. When the result of the above S136 is

35   negative, the program code instructions cause the CPU 112 to return to the above S121. The CPU 112 waits for a next detection signal to be detected within the

1   CCD 200 and read out from the memory of the CCD 200
     during the detection signal reading of the above S121.
             When the result of the above S134 is
     negative, the program code instructions cause the CPU
5   112 to perform the above S136, and the above
     coincidence processing S135 is not performed.
             FIG. 14 shows the on-hook processing in
     the CCD control processing routine of FIGs. 12 and 13.
             As described above, when it is
10   determined during the CCD control processing of FIGs.
     12 and 13 that the on-hook signal is detected, the on-
     hook processing of FIG. 14 is performed by the CPU 112
     of the CCD 200.   As shown in FIG. 14, the program code
     instructions cause the CPU 112 to control the switch
15   118 so that the switch 118 switches on the connection
     line of the converter unit 105 and the converter unit
     106 to connect the TU 101 and the TN 102 (S141).
     After the control of the switch 118 of the above S141
     is performed, the program code instructions cause the
20   CPU 112 to terminate the telephone call between the TU
     101 and the TN 102.   That is, the telephone call
     between the TU 101 and the TN 102 is finished.   After
     the above S142 is performed, the program code
     instructions cause the CPU 112 to return back to the
25   CCD control processing routine of FIGs. 12 and 13.
             FIG. 15 shows the DTMF processing and
     the DTMF notification in the CCD control processing
     routine of FIGs. 12 and 13.
             As described above, when the CPU 112 is
30   notified during the CCD control processing of FIGs. 12
     and 13 that the DTMF signal from the TU 101 is
     detected by the DTMF detection unit 109, the DTMF
     processing is performed by the CPU 112.
             As shown in FIG. 15, the program code
35   instructions cause the CPU 112 to determine whether
     the content of the DTMF signal from the TU 101 is
     included in the allocation table of FIG. 2 (S151).

1   When the result of the above S151 is negative, the
program code instructions cause the CPU 112 to control
the switch 118 so that the switch 118 switches on the
connection line of the converter unit 105 and the DTMF

5   generator unit 111 to connect the DTMF generator unit
111 to the TN 102 (S152). After the above S152 is
performed, the program code instructions cause the CPU
112 to control the DTMF generator unit 111 so that the
DTMF generator unit 111 generates a DTMF signal based

10   on the content of the DTMF signal sent by the TU 101,
and transmits the DTMF signal to the TN 102 (S153).
After the above S153 is performed, the program code
instructions cause the CPU 112 to control the switch
118 so that the switch 118 switches off the connection

15   line of the converter unit 105 and the DTMF generator
unit 111 to disconnect the DTMF generator unit 111
from the TN 102 (S154). After the above S154 is
performed, the DTMF processing of FIG. 15 is finished.
Therefore, the CPU 112 inhibits transmission of a DTMF

20   signal from the TU 101 to the TN 102 when the content
of the DTMF signal from the TU 101 is not included in
the allocation table containing the defines values of
the DTMF command signals for the plurality of
telephone services of the DPD 115.

25   When the result of the above S151 is
affirmative, the program code instructions cause the
CPU 112 to set the status portion of the memory of the
CCD 200 at the predetermined value (S155). After the
setting of the status portion of the above S155 is

30   performed, the program code instructions cause the CPU
112 to set the data portion of the memory at a value
indicated by the DTMF signal from the TU 101 (or from
the TN 102) (S156). After the setting of the data
portion of the above S156 is performed, the program

35   code instructions cause the CPU 112 to set the data
strobe signal in the on-state (S157). The DPD 115 is
notified by the CCD 200 that the event has occurred

due to the DTMF command signal sent by the TU 101.
After a given time period, the program code
instructions cause the CPU 112 to set the data strobe
signal in the off-state (S157). After the setting of
the data strobe signal of the above S157 is performed,
the DTMF processing of FIG. 15 is finished.

Further, as described above, when the
CPU 112 is notified during the CCD control processing
of FIGs. 12 and 13 that the DTMF signal from the TN
102 is detected by the DTMF detection unit 107, the
DTMF notification is performed by the CPU 112. During
the DTMF notification, the program code instructions
cause the CPU 112 to perform the above-mentioned steps
S155-S157 as shown in FIG. 15. Similarly, when the
above S157 is performed by the CPU 112, the DPD 115 is
notified by the CCD 200 that the event has occurred
due to the DTMF signal sent from the TN 102.

FIG. 16 shows the defined value
comparison processing in the CCD control processing
routine of FIGs. 12 and 13.

As described above, during the CCD
control processing of FIGs. 12 and 13, the CPU 112 is
notified that the DTMF signal from the TU 101 is
detected by the DTMF detection unit 109, and that the
CCD 200 is set in the defined value comparison mode,
and then the defined value comparison processing is
performed by the CPU 112.

As shown in FIG. 16, the program code
instructions cause the CPU 112 to get the character
(or the defined value) from the defined value
comparison mode setting command (S181). After the
above S181 is performed, the program code instructions
cause the CPU 112 to determine whether the content of
the DTMF signal from the TU 101 accords with the
character of the defined value comparison mode setting
command (S182).

When the result of the above S182 is

affirmative, the program code instructions cause the
CPU 112 to determine whether the defined value
comparison has normally ended (S183). When the result
of the above S183 is affirmative, the program code
5   instructions cause the CPU 112 to increment the
comparison pointer and returns a code indicating that
the defined value comparison yields coincidence and
normal end (S184). After the above S184 is performed,
the defined value comparison processing of FIG. 16 is
10   finished.
      When the result of the above S182 is
negative, the program code instructions cause the CPU
112 to initialize the comparison pointer and returns a
code indicating that the defined value comparison
15   yields non-coincidence (S185). After the above S185
is performed, the defined value comparison processing
of FIG. 16 is finished. When the result of the above
S183 is negative, the program code instructions cause
the CPU 112 to initialize the comparison pointer and
20   returns a code indicating that the defined value
comparison yields coincidence and abnormal end (S186).
After the above S186 is performed, the defined value
comparison processing of FIG. 16 is finished.
      FIG. 17 shows the coincidence
25   processing in the CCD control processing routine of
FIGs. 12 and 13.
      As described above, during the CCD
control processing of FIGs. 12 and 13, the CPU 112 is
notified that the return code obtained by the defined
30   value comparison processing indicates coincidence, and
then the coincidence processing is performed by the
CPU 112.
      As shown in FIG. 17, the program code
instructions cause the CPU 112 to control the switch
35   118 so that the switch 118 switches off the connection
line of the converter unit 105 and the converter unit
106 to disconnect the TN 102 from the TU 101 (S191).

1   After the above S191 is performed, the program code
instructions cause the CPU 112 to perform the
detection signal reading of FIG. 19 (S192).

After the detection signal reading of
5   the above S192 is performed, the program code
instructions cause the CPU 112 to determine whether
the on-hook signal is indicated by the return code
obtained by the detection signal reading (S193).

When the result of the above S193 is
10   affirmative, the program code instructions cause the
CPU 112 to perform the on-hook processing of FIG. 14
(S197). After the on-hook processing of the above
S197 is performed, the program code instructions cause
the CPU 112 to control the switch 118 so that the
15   switch 118 switches on the connection line of the
converter unit 105 and the converter unit 106 to
connect the TU 101 and the TN 102 (S198). After the
above S198 is performed, the coincidence processing of
FIG. 17 is finished.

20   When the result of the above S193 is
negative, the program code instructions cause the CPU
112 to determine whether the DTMF signal is indicated
by the return code obtained by the detection signal
reading (S194).

25   When the result of the above S194 is
affirmative, the program code instructions cause the
CPU 112 to determine whether the end signal is
detected (S195). When the result of the above S195 is
affirmative, the program code instructions cause the
30   CPU 112 to perform the above S198. After the above
S198 is performed, the coincidence processing of FIG.
17 is finished.

When the result of the above S195 is
negative, the program code instructions cause the CPU
35   112 to perform the DTMF notification of FIG. 15
(S196). After the above S196 is performed, the
program code instructions cause the CPU 112 to return

1   to the detection signal reading of the above S192.
On the other hand, when the result of the above S194 is negative, the program code instructions cause the CPU 112 to return to the

5   detection signal reading of the above S192.
Further, the present invention is not limited to the above-described embodiments, and variations and modifications may be made without departing from the present invention.

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